National Institute of Environmental Health Sciences

Environmental signatures associated with cholera epidemics

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Abstract:

The causative agent of cholera, Vibrio cholerae, has been shown to be autochthonous to riverine, estuarine, and coastal waters along with its host, the copepod, a significant member of the zooplankton community. Temperature, salinity, rainfall and plankton have proven to be important factors in the ecology of V. cholerae, influencing the transmission of the disease in those regions of the world where the human population relies on untreated water as a source of drinking water. In this study, the pattern of cholera outbreaks during 1998-2006 in Kolkata, India, and Matlab, Bangladesh, and the earth observation data were analyzed with the objective of developing a prediction model for cholera. Satellite sensors were used to measure chlorophyll a concentration (CHL) and sea surface temperature (SST). In addition, rainfall data were obtained from both satellite and in situ gauge measurements. From the analyses, a statistically significant relationship between the time series for cholera in Kolkata, India, and CHL and rainfall anomalies was determined. A statistically significant one month lag was observed between CHL anomaly and number of cholera cases in Matlab, Bangladesh. From the results of the study, it is concluded that ocean and climate patterns are useful predictors of cholera epidemics, with the dynamics of endemic cholera being related to climate and/or changes in the aquatic ecosystem. When the ecology of V. cholerae is considered in predictive models, a robust early warning system for cholera in endemic regions of the world can be developed for public health planning and decision making.

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Resource Description

Early Warning System: ☒

resource focus on systems used to warn populations of high temperatures, extreme weather, or other elements of climate change to prevent harm to health

A focus of content

Exposure : ☒

weather or climate related pathway by which climate change affects health

Ecosystem Changes, Food/Water Quality, Precipitation

Food/Water Quality: Biotoxin/Algal Bloom, Other Water Quality Issue

Water Quality (other): Chlorophyll a concentration (CHL); Sea surface temperature

Geographic Feature: ☑

resource focuses on specific type of geography

Freshwater, Ocean/Coastal

Geographic Location: ☑

resource focuses on specific location

Non-United States

Non-United States: Asia

Asian Region/Country: India, Other Asian Country

Other Asian Country: Banlagdesh

Health Impact: ☑

specification of health effect or disease related to climate change exposure

Infectious Disease

Infectious Disease: Foodborne/Waterborne Disease

Foodborne/Waterborne Disease: Cholera

Mitigation/Adaptation: ☑

mitigation or adaptation strategy is a focus of resource

Adaptation

Resource Type: ☑

format or standard characteristic of resource

Research Article

Timescale: ☑

time period studied

Time Scale Unspecified